DEPARTMENT OF CONSERVATION
DIVISION OF ADMINISTRATION
DIVISION OF MINES AND GEOLOGY
DIVISION OF OIL, GAS AND GEOTHERMAL RESOURCES
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February 17, 1998

Ms. Caroline Constable
Lake County Disaster Coordinator
County of Lake
333 Second Street
Lakeport, California 95453

RE: Engineering Geologic Inspection of Several Disaster Sites in Lake County

Dear Ms. Constable:

On February 10, 1998, the Department of Conservation, Division of Mines and Geology (DMG) responded to a request from the Governor's Office of Emergency Services (OES) to evaluate slope failures as part of a multi-agency inspection team for Mission # 98-CST 7200 in Lake County. Other participants included Gary L. Lewis, Code Compliance Office, Planning Division, and Craig Oliver, Chief Building Official, Building and Safety Division within the Community Development Department, County of Lake. We inspected two houses in danger of collapse onto Highway 20 along Clear Lake, two eroding earthfill dams in the same area, three earthfill dams south of Lower Lake, and two damaged roads in the vicinity of the City of Clear Lake.

GEOLOGY, SLOPE HAZARDS AND SITE DESCRIPTION

Site #1 11886 Wigeon Way (Keyed to Map):

This house site is immediately upslope from Highway 20 at MilePost 26.86+150 feet East. A cutbank collapse onto the westbound highway lane has undermined the ground beneath the back wall and foundation piers of a vacant dwelling. Bedrock at this site consists of Franciscan Complex mudstone (Manson 1989). Cutbank height is about 35 feet (estimated); cutbank slope is about 0.5:1. The scarp is about 50 feet wide.

The house foundation is post and pier, with five rows (front to back) of cinder block piers, 4x4-inch support posts and 2x4-inch bracing. The height of the posts increases for each row of piers due to the steepness of the hillslope (estimated to be 70 to 100 percent). The board-and-batten and plywood

structure is in fair to poor condition (rotten wooden handrailings and steps down to the front porch, plastic sheeting covering the roof, etc.). The house appears to have 3 or 4 rooms. A detached shed is located adjacent to the uncovered parking space.

The rear row of piers was supported by a block of soil 35 feet wide (side to side) and 15 feet long that dropped 6 feet down towards the highway. Only the corner pier closest to the shed remains in position. The rear of the house is collapsing. The 2x6-inch floor joists In the unsupported area are sagging and show cracks. A wooden window frame in the side wall has been distorted into a parallelogram with about 5 degrees of racking of the frame. If the structure is not braced or removed it probably will collapse and fall onto the highway, thereby endangering the public. There is no access for large equipment to the rear of the house for repairs. Thomas Hunt, C.E. (Ruzicka Associates, Lakeport), who is the home owner's engineer, stated that the cost of reconstructing the foundation exceeded the value of the structure.

A secondary cut bank collapse is located about 30 feet east of the shed, away from the house. The older portion of the landslide contains a distorted pine tree estimated to be at least 10 years old. Brush also is growing within the scarp. Some of the landslide area has moved recently, but is much smaller in extent that the block at the house.

Recommendation:

DMG concurs with the consultant's recommendation that the two structures and the large block of down-dropped soil should be removed to prevent collapse onto Highway 20.

<u>Site #2</u> 9015 Glenhaven Drive

Upslope from Highway 20 at MilePost 23.93 is a second house in danger of being undermined by headscarp migration of an older cutbank collapse. The house is a one-story frame structure with a finished cinderblock basement and elevated wooden deck (2x8-inch joist supported by 4x4-inch posts). The deck is attached to the rear of the house at its main floor level. The rear of the house faces Clear Lake (south) while the front of the house faces uphill (north). Gutters drain into a subsurface system and are discharged into a 12-inch steel culvert that extends down the old landslide scarp. The lower 40 feet of culvert was destroyed by the new landslide, and only the upper 20 feet is left in place.

Bedrock at this site is the Kelseyville Formation of Pleistocene age. The house is situated east of sand and gravel strata exposed in a bluff along the highway.

The strata strike to the north and dip gently to the east. There are apparent solution cavities on the bluff face about 30 feet above the highway. The landslide behind the house occurred in weathered colluvium within an old vegetated landslide scarp.
The head scarp and slip plane combined rise about 40 feet in elevation to the landscaped area behind the house. The head scarp is about 12 feet high, and the top of the new scarp is about 5 feet below the surface level of the ground behind the house. The house's rear basement wall is about 10 feet upslope from the top of the scarp. Post-and-plank retaining wall structures were installed in the sidescarp and headscarp areas after the previous landslide movement which, according to the homeowner occurred in 1980.

The old scarp is about 50 feet wide and is well vegetated with wild myrtle plants and some pine trees. The new landslide mass consisted of a 1- to 3-foot layer of soil and vegetation that moved down the slide plane from the 20-foot-wide headscarp. At the time of our inspection water was draining from three rivulets at the base of the headscarp at an approximate combined rate of one gallon in 10 seconds. Some of the plank retaining walls have been damaged. The slide plane will eventually daylight at the base of the rear of the house, or very close to it. The homeowner stated that there were no signs of groundwater leaking into the basement prior to or at the time of the new landslide. Spring boxes could be installed to collect and drain water from the headscarp area.

Recommendations

DMG recommends that homeowner should hire a Certified Engineering Geologist or Geotechnical Engineer for a detailed site investigation. The headward erosion of the scarp may occur only in response to periods of intense rainfall that over saturates the soil mantle. Perhaps only reno mattresses on the slip plane and a gabion basket structure installed at the headscarp (on a backtilted keyway bench, anchored into hillside with ground augurs) are all that is needed for retention. The groundwater level can be determined by drilling a vertical hole in the unpaved road in front of the house. If elevated ground water levels at the house are determined to be the driving force behind the landslide movement, then installation of a French drain system could reduce the water level.

Site #3 Highway 20, Dams at MilePost 21.43

The larger of two earthfill dams located in a steep, narrow canyon on Page Mountain upslope from Highway 20, was in danger of collapse due to piping. The two reservoirs were being drained by a California Department of Forestry and Fire Protection (CDF) Conservation Crew under the direction of California Department of Transportation (Caltrans) engineer G.W. (Jerry) Sheldon. The upper dam is located immediately upstream from the reservoir of the larger,

lower dam. The lower dam is about 60 feet long and impounds a 10-feet-deep reservoir. Through-dam piping has eroded a sink hole about 15 feet in diameter on the face of the dam. The top of the sinkhole is about 10 feet below the crest. Clear water was emanating from the piping hole and flowing downstream to the highway at the time of our inspection.

According to Sheldon the lower reservoir was discharging into overflow pipes at the time of first inspection on Monday, February 9. Emergency workers succeeded in lowering the reservoir level about 3 feet prior to our arrival. Sheldon proposed to lower the level another 2 feet that day (February 10) and another 2 feet on the next day (February 11). Lowering of the reservoir level was accomplished by cutting a narrow channel through the crest of the dam and draining the water into a Visquene-lined channel on the dam's face. A corrugated steel flume was salvaged from the upper dam and emplaced on the new drainage channel of the lower dam to prevent erosion of the new channel.

These dams were constructed several decades ago. According to Sheldon the dams were used for containment of sewage effluent. The liquid waste was pumped to a sprinkler system in another area for disposal. The dams apparently are abandoned.

Recommendations

DMG concur that two dams should be drained and removed as proposed by Sheldon. In addition, DMG recommend that all bare soil surfaces be seeded and mulched or covered with durable stone to minimize hillslope soil erosion and sediment yield to Clear Lake.

Site #4 Earthfill Dams at Twin Lakes Subdivision (south of Lower Lake)

Several small earthfill dams in this area were viewed for evidence of overtopping or collapse, but none showed any signs of possible failure. One large dam was examined on foot. There was no sign of distress in or damage to this earthfill dam. The dam's overflow pipe consists of a 12-inch culvert that discharges into a steel flume. The reservoir height was only 1 to 2 feet above the lip of the overflow pipe. This reservoir is estimated to be about 150 feet across and 15 feet deep.

Recommendations

None.

Site #5 Spruce Grove Road Reservoir (south of Lower Lake)

The earthfill dam is about 120 to 150 feet long, 10 feet wide at the top and 15 to 18 feet high. It impounds a reservoir about 100 yards long. The dam's face is gullied in three locations due to overtopping of the dam. A 48-inch steel culvert located in a grove of trees became plugged during storms due to branches and cattails. Soil washed out of the dam was flushed downhill to the County road at the base of the dam. The largest gully, which has eroded 3 feet across the top of the dam, is sandbagged to help prevent renewed overtopping of the reservoir. At the time of our inspection the reservoir water was within 6 inches vertically and 7 feet horizontally of the head of this gully.

Recommendations

DMG recommends (1) installation of a trash rack to help prevent plugging of the culvert, and (2) a Civil Engineer be retained to study the condition of the dam and to recommend repairs.

Site #6 Lakeview Road landslide (City of Clear Lake)

A 3 foot-thick wedge of topsoil and grass is slumping down onto the road. The landslide is about 30 feet wide and 40 feet high. The local Road department has installed two K-rail concrete barricades to confine the slumped material. Some hay bales were installed to filter the muddy water that drains from the soil. Runoff water flows across the road and discharges onto the grassy hillslope below the road. This slump appears to be the landslide shown by Manson (1989).

Recommendations

DMG recommends that the maintenance department continue to monitor the landslide and remove slumped material as necessary.

Site #7 Stubbs Road landslide (City of Clear Lake)

This is a subsurface rotational landslide involving the outer half of the road prism and the road shoulder into an unnamed creek. The creek bed is located about 25 feet downslope from the road level; the location of the slip plane was not determined. Recent movement has damaged the road surface and shoulder at the site of an older, repaired landslide. This new movement was triggered at least in part by placement of a spoils pile along the road shoulder as well as large amounts of rainfall. The new pavement breaks consist of arcuate cracks 7 to 8 feet in from the outer pavement edge. These cracks are about 50 feet long and each have 1-inch of vertical displacement. The fill shoulder is 8 to 10 feet wide. It also has vertical displacement on the cracks, with a maximum of 3-inch

displacement in the center of the landslide. A linear pile of saturated colluvium has recently been placed along the road shoulder. The weight of the 50 feet long, 5 feet wide and 2 feet high fill pile appears to be responsible for the renewed movement.

Recommendations

DMG recommends (1) the damaged lane be barricaded to keep traffic of the damaged pavement, and (2) the permanent repair include removal of the landslide material and replacement of this material as engineered fill.

References

Manson, Michael W., 1990, Landslide Hazards in the Eastern Clear Lake Area, Lake County, California -- Landslide Hazard Identification Map No. 16: California Department of Conservation, Division of Mines and Geology Open-File Report 89-27, 4 plates, scale 1:24,000.

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Michael W. Manson, CEG 1720
Associate Engineering Geologist

Concur:

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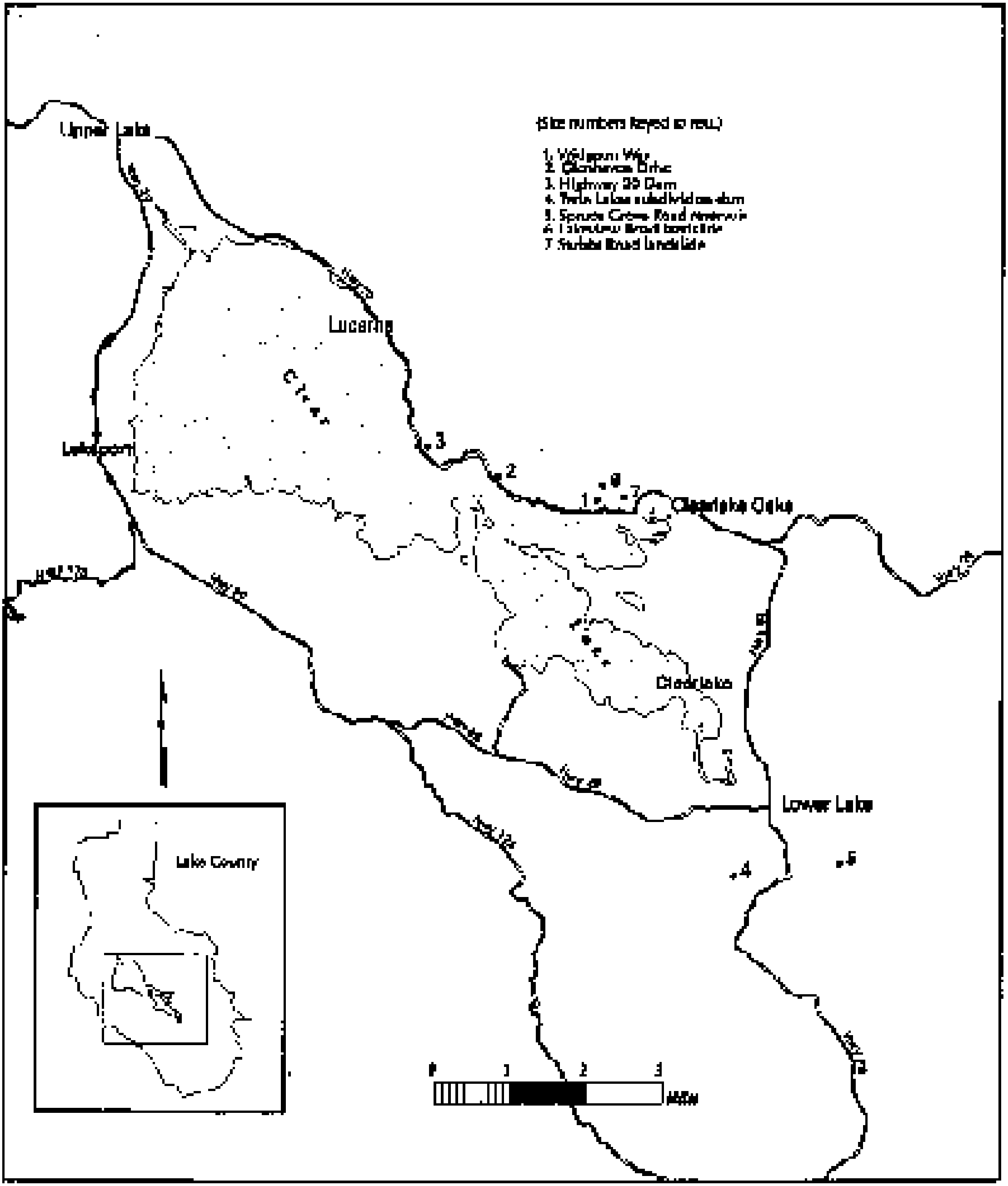
Date Trinda L. Bedrossian, CEG 1064
Supervising Geologist

Enclosure Location map

cc: James Davis
Richard Eisner



Map 1. Index of Lake County disaster sites